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PUBLIC INVESTMENTS EFFECT ON THE PRIVATE INVESTMENT IN BRAZIL FROM 1971 TO 2016: AN EMPIRICAL ANALYSIS USING VECTOR ERROR CORRECTION MODEL

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ABSTRACT

This work aims to analyze whether the investments of public administrations complement or replace private sector investments in Brazil between 1971 and 2016. Using the Error Correction Vector Model methodology, the results show that the crowding in effect of government investments predominates under the investments of the private sector. The results of the econometric estimations suggest that a 1% increase in public sector investments causes a 1.33% increase in private sector investments. In addition, the results show that rising interest rates and instability negatively affect private sector investments, confirming the theory for the Brazilian economy in the period under review.

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INTRODUCTION

The analysis period has two distinct periods of growth of the Brazilian economy. The first phase is characterized by the rapid economic growth of the 1970s, especially during the Economic Miracle (1969-1973) when the average rate of growth of the economy's output was around 10% per year. The second phase is characterized by a slowdown in growth between 1980 and 2016, with the economy's average output rate at approximately 2.4% per year. Brazil experienced a period of intensive investment, from the 1930s until the end of the II National Development Plan (the late 1970s). In this period, high levels of growth in the country were maintained by this development model. Such a model is characterized by the substitution of imports for which the state plays a central role in inducing growth. However, from the 1980s onwards the financing capacity was depleted with the materialization of the external debt crisis. The state was not robust enough to continue investing which led to a long period of slow growth coupled with a high inflation rate and recession. Two phenomena emerge from this reality: i) the state has failed to invest; ii) the macroeconomic instability of the 1980s led the entrepreneurs to maintain a defensive and risk-averse posture. The fall in the private investment rate of this period is a result of the widening of uncertainties arising from the successive failures of the 1980s economic plans, inducing capitalists to invest in the financial sector to the detriment of investments in the productive sector. In 1980, the GDP growth rate was around 2.2%.The subsequent decade was marked by the adoption of a neoliberal policy guided by the guidelines agreed upon in the Washington Consensus. The predominant feature of this period was the substitution of private capital for the tasks previously performed by the state (GIAMBIAGI, 2005). However, the new growth model did not result in distinct growth rates from the previous period: the Brazilian economy grows on average 2.2% per year from 1990 to 2016.Thus, if private investment is a typically endogenous variable that impacts on the growth of countries, the general objective of this paper is to elaborate an investment function and to test it empirically with data for the Brazilian economy from 1971 to 2016. In this sense, it is intended to analyses the influence on private investment of public administration investments, the variation of the Gross Domestic Product, the instability of the economy, the interest rate, the public debt service and the economic opening will be analyzed. For this purpose, the long- and short-term equations of the period from 1971 to 2016 were estimated. Emerging economies, such as Brazil, are characterized by the central role of the state in capturing the development process. Two hypotheses emerge from this reality

about the influence of public investment on private investment: i) the first hypothesis is that public infrastructure investments, in general, complement private investments, increasing the economy's productivity, encouraging the private sector to invest. In these circumstances, entrepreneurs perceive the improvement of infrastructure as possibilities that make projects viable, minimizing risks and increasing gains; ii) the second hypothesis is that public spending may negatively influence private investment. Many authors believe that due to the fledgling financial markets of developing countries, public spending may compete with the private sector for scarce resources, which would result in a substitution between public and private investment. The low saving rate or the fledgling financial system can generate competition for available resources, leading public investment to become a barrier to private investment. For the analysis of the determinants of private investment in emerging countries, the public investment variable is used as an explanatory variable for private investment. Thus, it is possible to identify whether the behavior of public spending causes an effect of crowding out or crowding in over private investment. This article was organized into three sections in addition to this brief introduction. The next section discusses the empirical literature on the subject. Section three reviews the literature on the referred subject. In section for the data source is presented, and the empirical tests are performed, as well as, the results are analyzed. Finally, in section five, the conclusions are presented.

Determinants of investments: A theoretical and empirical overview

The purpose of this section is to present the theoretical concepts that will serve as the basis for the construction of the investment function to be tested in section four. Three schools of thought are analyzed and how they shape investment, namely: neoclassical theory, Keynesian theory, and the accelerator theory of investment. At the end of this section a brief review of the literature on the subject is presented. In the neoclassical theoretical framework, whatever the markets, they will be continually adjusting for the economy to function at full employment without incurring excess supply or shortage of demand. Prices, interest rates, wages, etc., adjust repeatedly (through the Walrasian auctioneer) to keep the economy in balance. Thus, there are no crises of overproduction or underproduction, since aggregate supply equals aggregate demand, thus validating Say's Law. For neoclassical economists, profits are the result of investments, which in turn are directly related to the cost of capital. What conditions the realization of a given investment is that the profit factor, perfectly known, is higher than the cost of capital factor (which is given by the interest rate of the financial market). If the return on investment exceeds the cost of capital, implementation of the investment will be feasible; otherwise the investment does not happen. Entrepreneurs estimate future profits through rational expectations. These indicate that capitalists understand the true model of the economy, using all available information to make estimates of the future (Sachs and Larrain, 2000). Consequently, it can be said that investments are determined by the market: profits are perfectly known, as is the cost of capital (determined by the market interest rate). The financial market plays a key role in neoclassical analysis, making it possible for capitalists to raise funds with financial institutions when corporate profits are not enough to finance new investments. Third-party capital (obligations) acts as a perfect substitute for internal capital, as debt can be contracted without affecting the expected value of projects. Thus, the theory returns to the initial condition, namely that the investment made, either through own resources or through financial market contracting, will be viable if the costs of capital are lower than the (perfectly known) future profit.On the one hand, the neoclassical economic theory suggests that investments depend directly on savings: when there is a small amount saved, the interest rate will be high, and few investments will be made. On the other hand, when a large volume is saved, there will be a large amount of investment, as the interest rate will be low. The market will continually adjust so that all savings are demanded. Thus, aggregate savings through successive adjustments in the financial market will determine the realization of investments. On the other hand, it is widely accepted in the literature that Keynes conceptions of the economic environment, in which investments occur, differs from the neoclassical perception. To the Keynesian perspective, the economy is subject to random and unpredictable shocks that can suddenly change the environment in which investments occur, thus making it uncertain. Therefore, economic agents are not able to clearly predict future economic events. Under conditions of uncertainty, investment is determined by the animal spirit's mood, that is, investment decisions depend on the entrepreneur’s perspective on the future. It is the optimism that will make the capitalist opt for the productive sector over the financial sector - either to maintain its own resources or to take resources from others.

In Keynesian analysis, uncertainty, the result of economic instability, originates from the financial sector. In a capitalist economy, savings are linked to the productive sector through the financial sector. However, this sector is sensitive to exogenous shocks that convey the degree of insecurity and liquidity preference through the interest rate. In addition, the factors that generate savings are different from those that result in investments. Savings are a function of household income. Keynes assumes that consumers have a propensity to save on income that is a function of interest rates. Keynes assumes that economic agents prefer liquidity and are risk-averse while retaining currency - the economy's most liquid asset - to speculate. Thus, the demand for money is negatively related to the interest rate: the higher the interest rate, the lower the demand for money from individuals. In other words, families save based on the remuneration of capital (interest rate) predicting future consumption. The higher the interest rate, the more incentives families will have to give up present consumption for future consumption.In turn, entrepreneurs - lacking their own resources - demand the resources of the financial system (which is a source of instability in the economy) observing the cost of capital. Nevertheless, they observe the economic scenario which guides the quality of economic environment in investing. For entrepreneurs, the investment will be feasible if the expected future return on a project exceeds the cost of capital. Since the interest rate reflects the instability of the financial market, it ends up making the investment unstable by nature, since it is only realized while the expected return is higher than the cost of capital. The relevance of expectations for investments in the real sector is related to the existence of uncertainty, resulting from the time gap between decision making and investment and production. In addition, expectations are related to the economic environment in which investment decision making is

inserted and the one that exists when the results of this investment are obtained. From this perspective, the decision to invest is made under conditions of uncertainty, which require assumptions about future returns and present capital costs. Investment fluctuations result from an entrepreneur's intertemporal choice between retaining universal liquidity assets (currency) or undertaking them in creating specific liquidity assets (investment). This decision is determined by comparing the interest rate (understood in Keynesian theory as the liquidity waiver reward represented by the letter '*i*') and the capitalist's mood, which Keynes calls marginal capital efficiency (EMgK). Thus, the Keynesian investment function takes the following form: (*1*) *I = f (EMgK; i)*.

In short, in the Keynesian theoretical framework, the neoclassical identity in which saving equals investment is not confirmed: economic agents may choose to save without this saving necessarily becoming investments in the productive sector (which differs from the neoclassical conception that identifies such concepts). Finally, in the accelerator model, popular during the 1960s, investment is a fixed proportion of changes in output. The model assumes that the desired (or ideal) capital stock remains proportional to the output level, so that positive (negative) product variations will reflect positive (negative) investment variations. Mathematically, the model takes the following form: *(2)* $I = \Delta K = \alpha \cdot \Delta Y$. Where 'α' reflects the incremental capital-output ratio*(K/Y)*, supposedly constant. If the desired capital stock has a stable relationship to the production level, the model is determined by: *(3)* $K^* = \alpha \cdot \Delta Y$; *(4)* $I = K_{t+1} - K_t = \alpha Y_{t+1} - \alpha Y_t = \alpha(Y_{t+1} - Y_t) = \alpha \Delta Y$.

The accelerator model, however, does not consider the possibility of serial correlation of the investment, that is, the existence of lags in the decision making and implementation of private investment. Thus, in this model, the current investment volume only partially adjusts the current capital stock to the desired level. Thus, the capital level in period '*t*' depends only on the capital level of the previous period and the adjustment it requires to reach the desired level. The limitations present in the accelerator model of investments led to the inclusion of lagged variables in addition to the income level variable already predicted. With the incorporation of lags, the accelerator model came to be termed as "Flexible Investment Accelerator Model" and is expressed as follows: *(5)* $K - K_{t-1} = I = \lambda(K - K_{t-1})$.

Where $0 < \lambda < 1$indicates the speed of capital stock adjustment. The investment equation is determined by: *(6)* $I = \lambda[\alpha Y - K_{t-1}]$. Comparing the two versions of the accelerator model, the initial model does not include lags and supposes a constant ratio *(K/Y)*. In addition, it also assumes an instantaneous adjustment, so that $\lambda = 1$. Despite the modification of the accelerator model by incorporating the lags, factors such as cost of capital, profitability and expectations are overlooked. Presenting the three theories that support the empirical analysis it is important to highlight the scientific production on the subject. Some of the first empirical studies developed on the subject for the Brazilian economy began to be developed in the 1970s and spread over the following years. An overview of some empirical studies on the determinants of private investment, mainly on the impact of public investment over private investment is presented below. Melo and Rodrigues (1998), using data from 1970 to 1995 applied to the autoregressive vector methodology (ARV), concluded that the empirical analysis suggests that there is a negative relationship between inflation and investments; instability increases uncertainty and public investment crowds out (displaces) private investment. In the same sense, Rocha and Teixeira (1996), applying the least square methodology, from 1965 to 1990, identified a substitutive nature of public investment. In the same direction, Cruz and Teixeira (1999), using data from 1947 to 1999, applied to the ARV methodology, expectation of demand is the main factor in determining private investment; public investments displaced private investment in the short term, although in the long term there is complementarity between them. On the opposite direction, Ferreira (1996) applying an ARV methodology, using data from 1970 to 1993, obtain results that suggest that public spending on infrastructure has a positive effect on future product evolution as it would benefit private investment and labor. Corroborating such results, Ribeiro and Teixeira (2001), applying the same ARV methodology, using data from 1956 to 1996, concludes that public investment crowds in (complements to encourage) private sector investment. Besides that, balancing economic policy is beneficial for encouraging private sector investment – which would involve an appropriate real interest rate, an inflation rate close to that practiced by business partners, a competitive and predictable exchange rate – as well as strategies for public investment projects. In addition, Lélis *et al.* (2015), applying a vector error correction methodology, using quarterly data from 1996 to 2012, suggest that a random positive shock to government consumption, household consumption, available credit and capacity utilization, positively influences private investments in machinery and equipment during subsequent months. Besides that, increase in exports positively influences gross formation of capital, during the first two quarters. After this period, the effect changes to negatively influence the explained variable. A positive and isolated shock in the price of machinery and equipment has – during the first two quarters – a decrease in investments in machinery and equipment, but from the third quarter onwards the effect changes and has a positive influence.

Investment function estimation

The purpose of this section is to conduct the empirical test of the determinants of private investment in Brazil for the period 1971 to 2016 using annual data. This temporal cut was performed due to the availability of data provided by the Brazilian Institute of Geography and Statistics (IBGE). Empirical studies in Brazil are, in most cases, challenging due to the scarcity of available data. Nevertheless, the methodological change in the way of accounting for national accounts by the Brazilian Institute of Geography and Statistics (IBGE), in 2010, increased the challenge. According to the IBGE notes, the new methodology was applied and retroacted in the national accounts until the year 2000. Initially, the function that expresses the mathematical relationship between the variables included in the model is presented, as well as the expected signals of such variables, besides presenting the methodology used. The data were obtained from the database of the Instituto de Pesquisa Econômica Aplicada (IPEADATA), except for the real interest rate, the eternal debt service, and trade liberalization. The time series for external debt service was obtained from the Central Bank. The time series related to trade liberalization was obtained from the World Bank database. This series is obtained by the ratio of the sum of exports and imports in terms of GDP. For the real interest rate, the nominal interest rate series of the Bank

Deposit Certificates (CDB) obtained from IPEADATA was used. From the nominal interest rate (CDB) series, the following equation was applied to obtain the real interest rate: *(7)* $i_r = (\frac{(1+i_n)}{(1+\pi)}) - 1$.Where '$i_r$' is the real interest rate, 'i_n' is the nominal interest rate and 'π' is inflation by the General Price Index (IGP-DI). To create the series of economic instability, we used the inflation data (IGP-DI), released by the Fundação Getúlio Vargas (FGV), the real interest rate and the exchange rate (Reais per Dollar) average selling at the end of the period, following formula is applied in order to obtain the annual data: *(8) Inst.* $= (1 + \pi) + \Delta r + \Delta E$.Where '$\Delta r$' is the change in the real interest rate and 'ΔE' means the change in at the nominal exchange rate. The investment function has been estimated in relation to Gross Domestic Product, so that the following variables were converted in terms of GDP: private sector gross investment, general government gross investment, foreign debt service and trade opening. Then, the empirical tests performed were presented. The determinants of private investment in Brazil were systematized by the following function:

$$I^p = f(Y, I^G, Inst, Sd, r, AC, Dum)$$

Where 'I^p' reflects private sector investment; 'Y' represents growth rate of gross domestic product; 'I^G' means general government investment; '*Inst*' is the economic instability; '*Sd*' represents external debt service; '*r*' is the real interest rate; '*AC*' means commercial opening and '*Dum*' is the dummy variable which is intended to capture the methodological change proposed by IBGE (with a value of zero for the period from 1970 to 1999 and value one for the period from 2000 to 2019). Table 1 summarizes the effect each variable has on investment, as well as the expected signal from each one.

The economic literature defines the expected signals of the coefficients of the determinants of investments, as follows. Public investment can affect private investment in two ways through crowding in or crowding out. The nature of public investment will determine the direction of the impact on private investment, as well as the magnitude of investment that materializes as a result of such influence. Government investment in infrastructure tends to encourage private investment, but at the same time – especially in emerging economies such as Brazil – compete for scarce resources with the private sector. Thus, the signal of this variable cannot be predicted before the economic system adjustment process (ex-ante). The expected signal for the instability coefficient is negative, as a more unstable environment encourages capitalists to keep resources in the financial system at the expense of the real economy. The expected interest rate signal suggests that the increase in interest rates encourages resources to remain in the financial system, inhibiting productive investments. That said, the expected signal for this coefficient is negative. In addition, the expected sign for the output growth rate coefficient is positive, as this is a proxy for the number of transactions, which tend to increase with increasing demand, representing an increase in sales, which obviously encourages investments. The expected signal for the foreign trade opening coefficient is positive, as increased competition pressures domestic firms to expand investments in the risk of losing market share and reducing the amount of profit. Ultimately, a firm that does not invest tend to disappear from the market because it competes with companies that add technological development to their products or processes, producing at a lower cost. Finally, the size of the external deficit is one of the variables that exemplify the influence of foreign credit restrictions on the productive sector of emerging countries. High levels of indebtedness mean that the resources previously used to finance local companies must be transferred abroad to remedy services and burdens. Thus, an increase in services paid for external debt tends to diminish domestic resources for gross private sector fixed capital formation. Thus, the expected sign is a decrease in investments due to a heavier debt burden.

Time Series Unit Root Test

The E-views 10 econometric package was used to perform the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests in this study. The number of lags was defined by minimizing the Schwartz criterion. The critical value for establishing the existence or not of unit root was tabulated by MacKinnon (1996) and a critical value of 5% was used as a reference for determining the existence (or not) of unit root. In turn, to determine the level of integration of the variables we used the hypothesis that they all had intercept. In most tests the null hypothesis is that the series has a unit root, and therefore is not stationary. In the KPSS test, in turn, the null hypothesis is that there is no unit root. Table 2 summarizes the results. Five of the seven time series presented in this study had a unit root, the next step is to apply Johansen's (1991) methodology to check if there is at least one cointegrating vector and thus ensure that the regression has economic significance, that is, ensure that regression is not spurious. However, it is necessary to check in advance what is the best number of lags to be included in the ARV. For this purpose, Table 3 is presented below. The number of lags adopted in this study is one as suggested by most tests (LR, FPE, SC and HQ tests). The next step is to perform the trace test and the maximum eigenvalue test. Tables 4 and 5 show these cointegration tests.

Both the trace test and the maximum eigenvalue test indicate that there are at most four cointegrating equations at 5% significance, which ensures that the regression is not spurious. To test the stability of the Autoregressive Vector (ARV) or Error Correction Vector Models (ECVM), the roots of the polynomials formed in the model construction must all be larger than one in modulus. The software used here (Eviews 10), however, finds them reversed, so they must all be within the unit circle. If this happens, it can be said that the model is adequate. As can be seen from figure 1, the Inverse Roots of the AR Process Characteristics with a lag are within the unit circle. Then, it is necessary to analyze the order of the variables within the estimated model, in order to obtain the relationship of temporal precedence between the series that make up the analysis. The results point to the following causal relationship. The order of precedence of the coefficients is performed by the Granger causality test shown in Table 6.

Thus, it can be said that the temporal precedence of the variables included in the model happens as follows:$R \rightarrow Inst \rightarrow AC \rightarrow I^P \rightarrow SD \rightarrow Y \rightarrow I^G$. The next step is to estimate the cointegrating vector that governs the behavior of the variables involved in the analysis. In cases where the estimators are non-stationary but have at least one cointegrating vector, the econometric literature indicates that an EVC is used. The elasticities are presented in Table 7.

Table 1. Variables Included in the Investment Function and Expected Signals

Variable	Expected Signal
Private Investment (I^P)	Interest Variable
General Government Investment (I^G)	Undetermined
Gross Domestic Product (Y)	Positive
Economic Instability ($INST$)	Negative
Real Interest Rate (r)	Negative
External Debt Service (SD)	Negative
Foreign Trade Openness (AC)	Positive

Source: the author himself.

Table 2. Unitary Root Test on Variables

Variable	ADF(critical value at 5%)	PP(critical value at 5%)	KPSS(critical value at 5%)	Integration Degree
I^P	-2.519884 (-2.938987)	-2.495909 (-2.938987)	0.492507 (0.463000)	I(1)
$D(I^P)$	-7.834683 (-2.941145)	-7.743216 (-2.941145)	0.377400 (0.463000)	
I^G	-2.188492 (-2.938987)	-2.188152 (-2.938987)	0.489636 (0.463000)	I(1)
$D(I^G)$	-5.689226 (-2.948404)	-5.566166 (-2.941145)	0.177996 (0.463000)	
Y	-3.596666 (-2.938987)	-3.472715 (-2.938987)	0.456063 (0.463000)	I(0)
AC	-1.842666 (-2.926622)	-1.900180 (-2.926622)	0.647855 (0.463000)	I(1)
$D(AC)$	-6.203367 (-2.928142)	-6.276065 (-2.928142)	0.073551 (0.463000)	
SD	-4.287803 (-2.935001)	-2.509476 (-2.928142)	0.088608 (0.463000)	I(0)
$D(SD)$		-7.423763 (-2.929734)		
$INST$	-1.545571 (-2.943427)	-2.527195 (-2.938987)	0.149479 (0.463000)	I(1)
$D(INST)$	-7.598251 (-2.943427)	-9.587649 (-2.941145)		
R	-2.497141 (-2.938987)	-2.423617 (-2.938987)	0.183676 (0.463000)	I(1)
$D(r)$	-6.059123 (-2.943427)	-9.775862 (-2.941145)		

Source: Results generated by E-Views 10 (2019).

Table 3. Definition of the Number of ARV Lag.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	413.9492	NA	3.00e-17	-18.17951	-17.61181	-17.96898
1	548.0045	213.2699*	6.55e-19*	-22.04566	-19.49103*	-21.09828*
2	598.9775	64.87467	7.34e-19	-22.13534*	-17.59377	-20.45111

Source: Results generated by E-Views 10 (2019).

Table 4. Trace Cointegration Tests

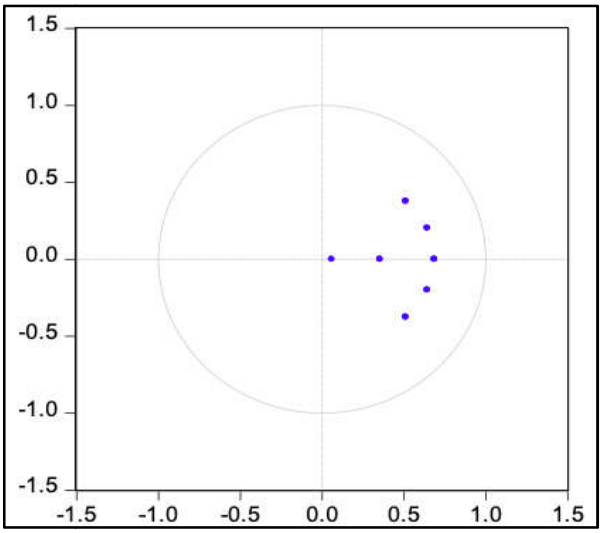
Hypothesis of number of cointegration equation	Eigenvalue	Statistic Trace	Critical Value at 5%
None	0.832343	228.6694	125.6154
Maximum 1	0.713512	153.6643	95.75366
Maximum 2	0.632503	101.1619	69.81889
Maximum 3	0.509374	59.11820	47.85613
Maximum 4	0.383127	29.21113	29.79707
Maximum 5	0.179758	8.921275	15.49471
Maximum 6	0.014154	0.598707	3.841465

Source: Results generated by E-Views 10 (2019).

Table 5. Maximum Eigenvalue Cointegration Test

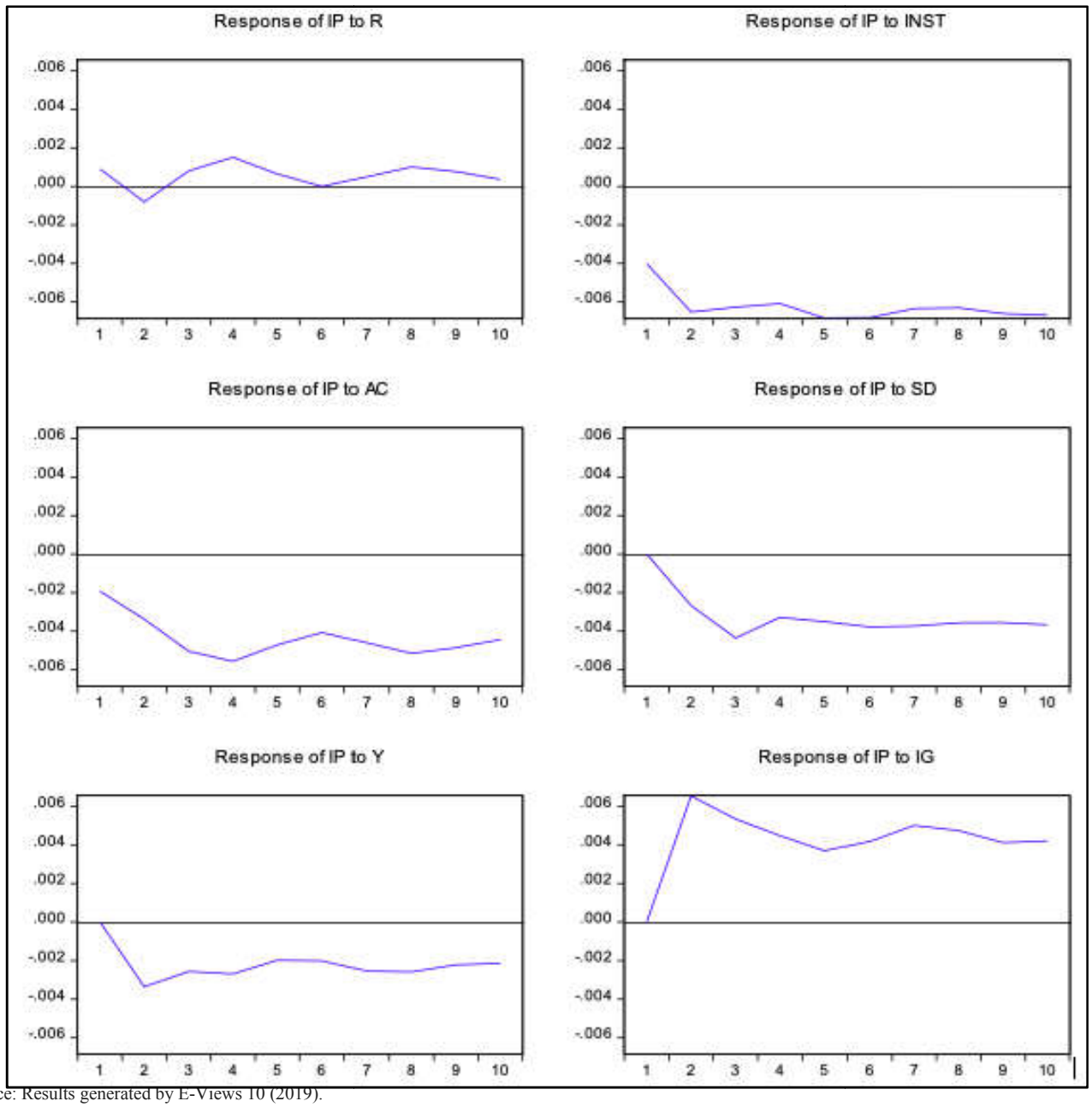
Hypothesis of number of cointegration equation	Eigenvalue	Maximum Statistic Eigenvalue	Critical Value at 5%
None	0.832343	75.00503	46.23142
Maximum 1	0.713512	52.50239	40.07757
Maximum 2	0.632503	42.04372	33.87687
Maximum 3	0.509374	29.90707	27.58434
Maximum 4	0.383127	20.28986	21.13162
Maximum 5	0.179758	8.322568	14.26460
Maximum 6	0.014154	0.598707	3.841465

Source: Results generated by E-Views 10 (2019).



Source: Results generated by E-Views 10 (2019).

Figure 1. Inverse Roots of Characteristic Polynomials of Autoregressive Processes



Source: Results generated by E-Views 10 (2019).

Figure 2. Boost-Response Function on Private Investment

Table 6. Granger Causality Test

Coefficient	Chi-Square Sum
Real Interest Rate (r)	30.39364
Economic Instability (INST)	20.41440
Foreign Trade Openness (AC)	11.10296
Private Investment (I^P)	9.880588
External Debt Service (SD)	6.106830
Gross Domestic Product (Y)	5.528785
General Government Investment (I^G)	4.112105

Source: Results generated by E-Views 10 (2019).

Table 7. Error Correction Vector (EVC)

Variable	Short Run Adjustment Coefficient	T-Statistic
Real Interest Rate (r_{t-1})	-0.001391	-1.26537[c]
Economic Instability ($INST_{t-1}$)	-0.005191	-1.13785[c]
Foreign Trade Openness (AC_{t-1})	0.118418	0.81643
Private Investment (I^P_{t-1})	0.298914	1.56423[b]
External Debt Service (SD_{t-1})	-0.162343	-0.70143
Gross Domestic Product (Y_{t-1})	-0.029094	-0.40436
General Government Investment (I^G_{t-1})	1.331205	1.89333[a]
Constant (c)	0.000625	0.17482
Cointegrating Equation	0.001936	1.35305[b]

Source: Results generated by E-Views 10 (2019).
Note: "a", "b" and "c" indicate, respectively, that the estimated parameters are significantly different from zero at the 5, 10 and 15% level.

Estimated coefficients indicate that real interest rate, economic instability, private investment and public investment are statistically significant. The estimated function indicates that 64.89% of private investment variations are explained by the significant variables generated by the error correction vector model, with the remainder being borne by the error. The results suggest that the estimated coefficient for gross fixed capital formation of the private sector responds positively to increases of this same lagged variable, causing them to rise by 0.29% in subsequent periods. On the other hand, a 1% increase in public sector investments causes a 1.33% increase in private sector investments. This indicates that there is crowding in between the private sector and public investment. In addition, the coefficient for real interest rate and economic instability shows that the increase of 1% of these variables implies a reduction of 0.0013% and 0.0051%, respectively. Finally, the impulse-response functions allow us to observe the impact of a positive shock on explanatory variables on private sector investment. This analysis is presented in figure 2 below.

Figure 2: Boost-Response Function on Private Investment

The impulse-response function applied in the VEC, estimated here, shows the effect of simulating an isolated positive shock on the explanatory variables. When applied to the real interest rate, it causes a drop in private sector investment until the second year. Regarding the effect of simulating a positive shock on the instability variable, it is observed that private investment remains in a negative equilibrium trajectory for over ten consecutive years. Considering the impulse-response function that a positive isolated shock of trade liberalization on private investment, it is observed that after the shock the tendency is for private sector investment to fall. The impact that a positive isolated shock on external debt service has on private sector investment shows that the effect is substantially negative over the next ten years. The effect of a positive and isolated shock on GDP is negative and remains over subsequent years. This result deviates from what is expected, as economic growth tends to encourage - via the accelerating effect - private sector investment. Finally, the effect of a positive and isolated shock on public sector investment on private sector investment is positive and remains on a positive equilibrium trajectory over subsequent years - showing that in Brazil government investments occur, mainly in infrastructure and overlaps with the limited financial system.

Conclusion

This paper aimed to conduct an empirical analysis of the determinants of private investment in the Brazilian economy from 1971 to 2016. The results suggest that public spending in Brazil produces a predominantly crowding in effect, therefore, investment public sector rather than replaces private sector investment, causing synergy between them. The crowding in effect may have been due to public investments occurring in sectors where private capital has no incentive to enter, or infrastructure. Moreover, it is possible that the high magnitude of such investments may be a barrier to private capital. The results show that the trade liberalization in the first half of the 1990s the greater competitiveness to which domestic companies were exposed led to a retraction of private investments. The truth is that, in fact, trade liberalization led to unemployment and a widening recession at first. The fact is that there was no government effort to devise industrial policies that would prepare the domestic industry to face competition from significantly more competitive companies. The simulation of a random shock on this variable produces a decrease on private investment, which only resumes its trajectory towards equilibrium from the fifth year.In addition, the results show that a simulated random shock on interest rates and instability has a negative, albeit marginal, effect on private investment (confirming economic theory). The text contributes to the empirical literature by providing new evidence on the dynamics between private investments and their theoretical determinants, especially regarding the methodology used. Moreover, it intends to indicate what the government's economic policies should be, with a view to sustained growth of private investment and, consequently, of output. In times of crisis, as the Brazilian economy is currently, the result presented here is decisive: the government should consider public investments in complementary sectors associated with infrastructure, aiming at the growth of private investment and, consequently, higher growth of the product in the future. In addition, a policy of keeping interest rates at a low level would contribute to the growth in the level of economic activity.

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